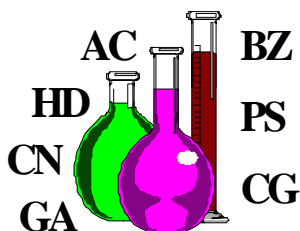


## *U.S. Army Center for Health Promotion and Preventive Medicine*



### *Detailed Facts About Blister Agent Mustard-Lewisite Mixture (HL)*

218-15-1096

#### *Physical Properties of Mustard-Lewisite Mixture*

***Chemical Formula***

HD:  $\text{Cl-CH}_2\text{-CH}_2\text{-SCH}_2\text{-CH}_2\text{-Cl}$   
L:  $\text{C}_2\text{H}_2\text{AsCl}_3$

***Description***

HL is a liquid mixture of mustard (HD) and Lewisite (L) designed to provide a low freezing point for use in cold weather and high altitudes. The eutectic mixture (lowest freezing point) is 63% lewisite and 37% mustard. HL has a garlic-like odor from its HD content.

***Molecular Weight***

186.4, based on the eutectic mixture.

***Boiling Point***

Indefinite, but below 190°C; decomposes before boiling.

***Vapor Pressure (mm Hg)***

0.248 @ 20°C

***Freezing Point***

-25.4°C pure;  
-42°C plant purity (calculated)

***Density***

Liquid = approximately 1.66 @ 20°C  
Vapor = 6.4 (air = 1)

***Solubility***

Practically insoluble in water.

***Flash Point***

High enough not to interfere with the military use of agent.

***Volatility***

240 mg/m<sup>3</sup> @ -11°C  
2,730 mg/m<sup>3</sup> @ 20°C  
10,270 mg/m<sup>3</sup> @ 40°C  
(Calculated from above vapor pressure; actual volatility is somewhat lower.)

**Agent HL** - The chemical mixture of Sulfur Mustard and Lewisite. Chemical Abstract Service Registry Number is not available.

### ***Toxicity Values***

LCt <sub>50</sub> (inhalation)	= about 1,500 mg-min/m <sup>3</sup>
LCt <sub>50</sub> (skin)	= about 10,000 mg-min/m <sup>3</sup>
ICt <sub>50</sub> (eye)	= 200 mg-min/m <sup>3</sup>
ICt <sub>50</sub> (skin)	= 1,500 to 2,000 mg-min/m <sup>3</sup>

### ***Exposure Limits***

Workplace Time-Weighted Average -	0.003 mg/m <sup>3</sup>
General Population Limits -	No standard available

## ***Toxic Properties of Mustard-Lewisite Mixture***

*HL is a vesicant agent that is not detoxified in the body. Locally, HL affects both the skin and eyes.*

### ***Overexposure Effects***

HL is a vesicant and alkylating agent producing cytotoxic action on the hematopoietic (blood-forming) tissues, which are especially sensitive. The rate of detoxification of HL in the body is very slow, and repeated exposure produces a cumulative effect. Contamination of the skin produces immediate stinging of the skin, turning red within 30 minutes. Blistering is delayed for about 13 hours and tends to cover the entire area of reddened skin. Blisters from HL exposures are deeper and more painful than with HD. Local action on the eyes is extremely rapid, and produces severe necrotic damage and loss of eyesight. Exposure of eyes to HL vapor or aerosol produces lacrimation, photophobia, and inflammation of the conjunctiva and cornea. When HL vapor/aerosol is inhaled, the respiratory tract becomes inflamed after a few hours latency period, accompanied by sneezing, coughing, and bronchitis, diarrhea, and fever. The respiratory damage is similar to that produced by mustard, except in the most severe cases. In these cases, fluid in the chest cavity may accompany fluid in the lungs. HL is absorbed through skin contact and inhalation of vapors, causing systemic toxicity such as damage to the lungs, bone marrow, lymph nodes, spleen, and endocrine system.

### ***Emergency and First Aid Procedures***

Inhalation: remove from the source immediately; give artificial respiration if breathing has stopped; administer oxygen if breathing is difficult; seek medical attention immediately.

Eye Contact: speed in decontaminating the eyes are absolutely essential; remove person from the liquid source; flush the eyes immediately with water by tilting the head to the side, pulling the eyelids apart with the fingers and pouring water slowly into the eyes; do not cover eyes with bandages; but if necessary, protect eyes by means of dark or opaque goggles; seek medical attention immediately.

Skin Contact: don respiratory protective mask and gloves; remove victim from agent source immediately; flush skin and clothes with 5 percent solution of sodium hypochlorite or liquid

household bleach within one minute; cut and remove contaminated clothing; flush contaminated skin area again with 5 percent sodium hypochlorite solution, then wash contaminated skin area with soap and water; wash thoroughly if shower facilities are available; seek medical attention immediately.

Ingestion: do not induce vomiting; give victim milk to drink; seek medical attention immediately.

### ***Protective Equipment***

Protective Gloves:	Wear Butyl toxicological agent protective gloves (M3, M4, or glove set).
Eye Protection:	Wear chemical goggles as a minimum; use goggles and face shield for splash hazard.
Other:	Wear gloves and lab coat for general lab work; have an M9, M40, or M17 mask readily available.

### ***Reactivity Data***

Stability:	Stable at ambient temperatures and in lacquered steel containers. HL is a persistent agent depending on pH and moisture and has been known to remain active for up to three years in soil.
Incompatibility:	Conditions to avoid: rapidly corrosive to brass @ 65°C; will corrode steel at a rate of .0001 inches of steel per month @ 65°C.
Hazardous Decomposition:	HL will hydrolyze into HCL, thiodiglycol, and non-vesicant arsenic compound.
Hazardous Polymerization:	Will not occur.

<b><i>Persistency</i></b>	Depends on munitions used and the weather. Somewhat shorter than that of HD, heavily splashed liquid of which persists 1 to 2 days under average weather conditions, and a week or more under very cold conditions.
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### ***References***

1. Department of the Army Field Manual (DA FM) 3-9, *Potential Military Chemical/Biological Agents and Compounds*, 1990.

2. *The Merck Index, An Encyclopedia of Chemicals, Drugs, and Biologicals, Eleventh Edition*, Merck & Co., Inc., Rahway, New Jersey, 1989.
3. U.S. Army Chemical Research, Development and Engineering Center, *Material Safety Data Sheet: HL*, January 1991.
4. U.S. Army Chemical Command Materiel Destruction Agency, *Site Monitoring Concept Study*, 15 September 1993.

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